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Hydrotherapy and its effects on chronic pain intensity, physical functionality and quality of life in the elderly

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Abstract

Chronic pain is often associated with impaired muscle strength and limited physical activity and performance, resulting in impaired physical functioning. This study aimed to determine whether voluntary participation in a structured 6-week hydrotherapy exercise programme would improve pain management, functionality and quality of life in an elderly population (n = 22; 77.7 ± 6.6 y) suffering from chronic pain and living in nursing homes in Tshwane. The experimental group (n = 13) attended hydrotherapy classes twice a week for six weeks, while the control group (n = 9) did not. Questionnaires were completed (Chronic Pain Grade, Functional Status Index, and the SF 36), and functional testing performed, in both groups at weeks 0, 3 and 6. The experimental group reported reduced pain intensity at week 3 ($p = 0.051$); reduced pain-induced disability at week 6 ($p = 0.080$); reduced assisted help required for activities of daily living (ADL) at week 3 ($p = 0.040$); reduced difficulty on performing ADL at week 3 ($p = 0.012$) and reduced pain experienced with ADL at week 3 ($p = 0.007$) and week 6 ($p = 0.014$). Improvements in upper body strength and agility were demonstrated. Improvements in subscales for quality of life were demonstrated at weeks 3 and 6. The control group showed no statistically significant changes in the above parameters. In conclusion, participation in structured hydrotherapy classes has been shown in this small study to be a beneficial intervention strategy for managing chronic pain in the elderly.

Keywords: Chronic pain, hydrotherapy, elderly, functionality, quality of life.

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Introduction

The International Association for the Study of Pain defines chronic pain as pain which persists beyond the usual time of expected healing, which is usually assumed to be three months (International Association for the Study of Pain, 2014). Advancing age is associated with a higher prevalence of chronic pain

disorders (Ruoff, 2002; Yücel & Kayihan, 2011; Gobbo, Bergamin, Sieverdes, Ermolao & Zaccaria, 2014). Between 80% and 85% of the elderly living in nursing homes suffer from chronic pain disorders (Ruoff, 2002; Brown, Kirkpatrick, Swanson & McKenzie, 2011). Chronic pain disorder among the elderly include arthritic joint disorders, fibromyalgia, neuropathic pain, osteoporosis and lower back pain (Lansbury, 2000; Tuzu, 2007; Ruoff, 2002; Barsante Santos, Schulze Burti, Lopes, Scazufca, Marques & Pereira, 2010; Atkinson, Fudin, Pandula & Mirza, 2013). The perception of pain may also be altered by aging and may cause disturbances in activities of daily living (ADL) and in quality of life (QoL) (Yücel & Kayihan, 2011). Undertreated pain is associated with detrimental effects on sleeping patterns mood states psychological and physical functioning (Clarke & Eccleston, 2009; Woo, Leung & Lau, 2009; Brown et al., 2011) QoL (Tuzu, 2007; Yücel & Kayihan, 2011) and performance of ADL (Gagliese & Melzak, 1997; Brown *et al*., 2011). Furthermore, decreased functionality is inversely related to QoL (Tuzu, 2007; Ozturk, Simsek, Yumin, Sertel & Yumin, 2011) and higher ratings of pain show positive relation to lowered QoL and higher levels of disability (Geytenbeek, 2002; Eyigor, Eyigor & Uslu, 2010). The development of appropriate pain management strategies is therefore a priority for those healthcare professionals working with the rapidly aging general population (Ruoff, 2002; Brown *et al*., 2011; Arneric, Laird, Chappell & Kennedy, 2014).

Regular exercise has been shown to have beneficial effects on those suffering from chronic pain (Cozzensa da Silva, Mattioli, Lessa, Zanchet & Blois, 2012). Additionally, physical activity has been demonstrated to improve muscle strength, aerobic power, flexibility, and balance (Devereux, Robertson & Briffa, 2005; Melzer, Elbar, Tsedek & Oddson, 2008), all of which are essential aspects of physical functioning. Physical activity allows performance of more integrated functional tasks and aids in the preservation of independent living (Garatachea, Molinero, Martínez-Garcia, Jiménez-Jiménez, González-Gallego & Márquez, 2009; Carvalho, Novais, Carrapatoso, Santos & Mota, 2012). Hydrotherapy – supervised exercise in warm water – is a popular modality which is often used. (Geytenbeek, 2002; Eversden, Maggs, Nightingale & Jobanputra, 2007). The mechanisms for the pain relief experienced in response to hydrotherapy include the effects of pressure and temperature on skin and nerve endings (Bender, Gutenbrunner & Sukenik, 2005); muscle relaxation (Bender et al., 2005; Eversden *et al*., 2007; Wong & Scudds, 2009); increased circulation (Hall, Swinkels, Briddon & McCabe, 2008); hydrostatic pressure reducing peripheral oedema; reduced sympathetic nervous system activity (Hall *et al*., 2008); and improvement in mood and anxiety (Bender *et al*., 2005). According to Becker (2009), the effects are both acute and long term and hydrotherapy may be an appropriate treatment modality for a wide spectrum of pain disorders.

The term "QoL" is associated with personal satisfaction and health perception and is related to physical, emotional, behavioural, cognitive and intellectual functions (Gokkaya, Gokce-Kutsal, Borman, Ceceli, Dogan, Eyigor & Karapolat, 2012). It is therefore a measurement method based on the perspective of the individual (Gokkaya *et al*., 2012). It has been shown to improve with physical activity (Michalsen, Ludtke, Buhring, Spahn, Langhorst & Dobos, 2003). This may be attributed to feelings of increased independence and decreased perceptions of disability (Ozturk *et al*., 2011; Tuzu, 2007).

The present study was designed and conducted to determine whether participation in a 6-week structured hydrotherapy exercise programme by elderly individuals suffering from chronic pain would decrease chronic pain intensity, improve functional ability and improve perception of QoL.

Methodology

Thirty-nine participants from three nursing homes in and around Tshwane volunteered to participate in the study; however, 17 participants withdrew and/or were excluded from the study. The reasons for withdrawal and exclusion were: unable to attend 50% of the sessions (data excluded from analysis); dislike of hydrotherapy as therapeutic modality and/or being hospitalised during the course of the study.

After all the exclusions and withdrawals, the experimental group comprised 13 participants and the control group (participants who volunteered for the study but did not want to participate in the hydrotherapy programme) numbered 9 participants (n = 22). Overall, three men and 19 women (aged 77.7 ± 6.6 y) participated. The study protocol was approved by the RESPethics committee of the Faculty of Humanities at the University of Pretoria.

All participants had the protocol explained to them and signed informed consent, after which they completed questionnaires and physical tests to track any alteration in chronic pain and/or functionality throughout the intervention. Perception of chronic pain was assessed using the Chronic Pain Grade (CPG) questionnaire (Smith, Penny, Purves, Munro, Wilson, Grimshaw, Chambers & Smith, 1997). The questionnaire determines pain intensity, pain related disability, and the number of days that pain interferes with ADL. Seven questions are asked requesting participants to rate their pain and disability on a 1 – 10 scale where 0 is "no pain/disability" and 10 is "pain/disability as bad as it could be". Pain intensity and disability were calculated individually from the answers as a score between 0 – 100 (Smith *et al.*, 1997). The Functional Status Index (FSI) questionnaire (Jette, 1980) was used to self-report assistance required with ADL, as well as pain and difficulty experienced while performing ADL. Physical functionality testing was administered *via* two

performance-based measures of the Senior Fitness Test (Jones & Rikli, 2002). The seated 30-second arm curl test was administered to assess upper body strength and endurance, and the 8-foot up and go test was utilised to assess agility/dynamic balance. The Short Form 36 (SF-36) was filled out by participants to report on perceived QoL. The scale allows assessment of eight subscales including physical functioning, role functioning, bodily pain, general health, vitality, social functioning, emotional and mental health (Sokka, 2003).

Participants in the experimental group each participated in a 45 – 60 min group hydrotherapy exercise session twice weekly for six weeks at the hydrotherapy pool of the Institute for Sport Research of the University of Pretoria. All of the questionnaires, as well as the performance-based measures were administered at pre-intervention (week 0), mid-intervention (week 3), and post-intervention (week 6).

Results

Data analysis used non-parametric statistics because of the small number of participants, and applied $p \leq 0.05$ when commenting on the statistical significance of scores. For inter-group comparisons, the Mann-Whitney U test was applied while for intra-group comparisons Friedman's two-way analysis of variance by ranks was used. To determine the correlation between functionality and chronic pain, Spearman's rank order correlations was used.

The Chronic Pain grade (CPG)

At the onset of the study both the experimental and control group experienced moderate levels of chronic pain as rated "at the present time" (ie. experimental group: 5.5 ± 1.9; control group: 4.9 ± 2.1). However, when the scores for all seven questions of the CPG were calculated and expressed as a rating from 0 to 100 (Smith *et al.*, 1997) both groups reported mild pain intensity and pain related disability (Figure 1). No significant difference in baseline scores between the groups for either calculated pain intensity or pain related disability was present. At mid-intervention the experimental group reported calculated pain intensities significantly lower ($p = 0.050$) than the control group (Figure 1). The calculated pain intensity experienced by the experimental group decreased from the pre-intervention level throughout the study while that of the control group did not change significantly (Figure 1).

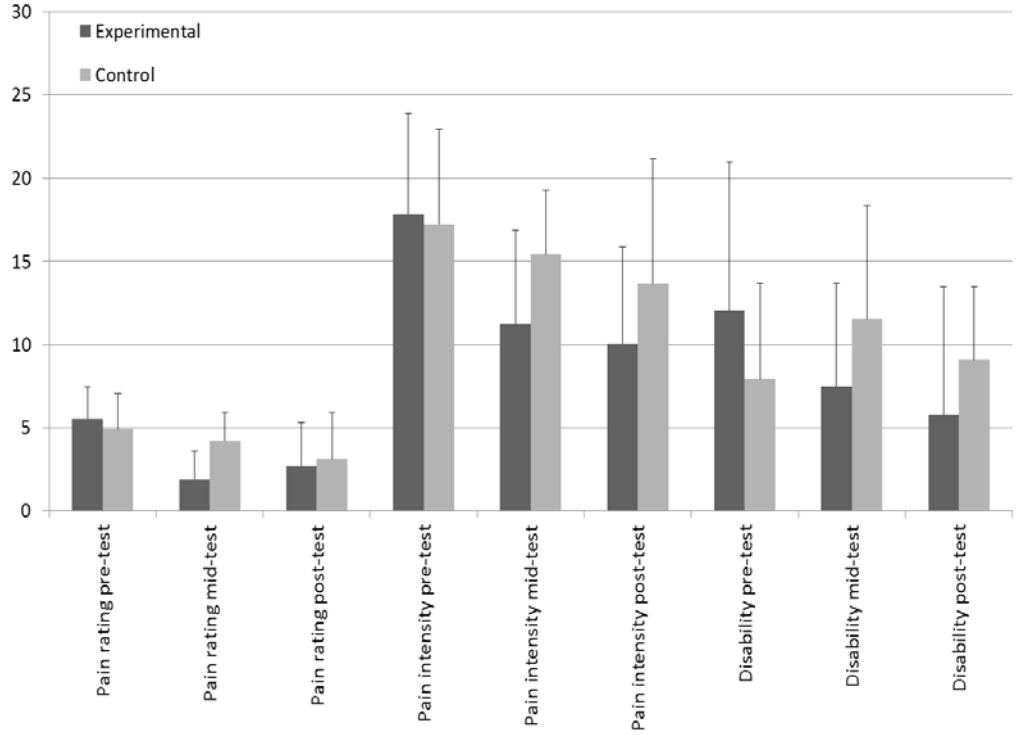

Figure 1: Scores for pain rated "at the present time"; and calculated pain intensity and pain related disability subscales of the CPG questionnaire

Functional Status Index (FSI) questionnaire

At the onset of the study there were no significant differences in functional status between the groups. After the hydrotherapy intervention the experimental group reported statistically significant decreases in: assisted help required for ADL at week 3 ($p = 0.040$) and difficulty of performing ADL at week 3 ($p = 0.012$) as well as decrease in pain experienced with ADL at week 3 ($p = 0.007$) and week 6 ($p = 0.014$). The variations in functional status within each group throughout the course of the study were not statistically significant.

Physical performance (functionality) tests

The experimental and control groups were not equally matched on upper-arm strength at pre-intervention (week 0) in that the experimental group was significantly stronger than the control group ($p = 0.017$). The experimental group significantly improved their arm strength at mid- ($p = 0.002$) and post-intervention ($p = 0.001$) testing while the control group demonstrated no significant improvements (Figure 2).

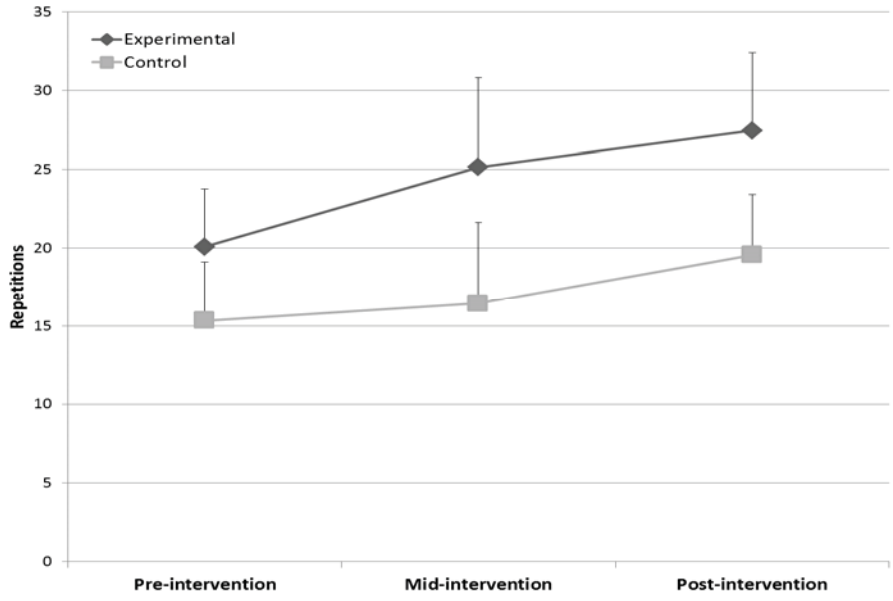

Figure 2: Number of seated arm curls performed in 30 s against a hand held resistance of 2.5 kg

No significant between-group difference in lower-body strength and functionality (agility) was present during pre-intervention testing. The experimental group significantly ($p = 0.023$) improved their agility in response to the hydrotherapy exercise while no significant changes were demonstrated by the control group (Figure 3).

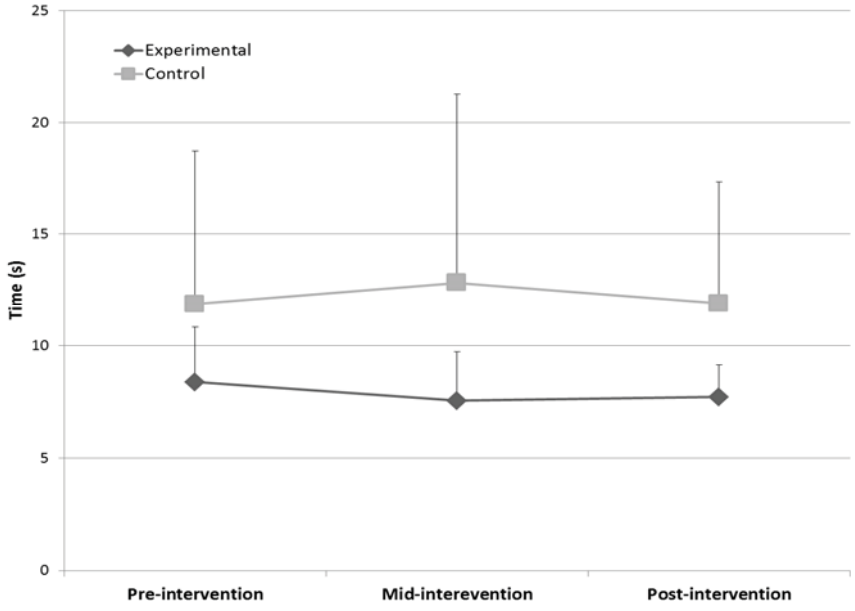

Figure 3: Time to complete the 8-foot up and go test

Short form 36 (SF 36) – Quality of life

Statistically significant differences in the following subscales were reported for inter-group comparisons: bodily pain for post-intervention ($p = 0.039$); general health for mid- ($p = 0.033$) and post-intervention ($p = 0.012$); vitality for post-intervention ($p = 0.012$); social functioning for mid-intervention ($p = 0.041$); emotional health at pre- ($p = 0.022$) and mid-intervention ($p = 0.008$); and mental health at mid-intervention ($p = 0.007$). These subscales show that the experimental group experienced greater improvements in QoL compared to the control group.

Correlations between the CPG and FSI

In correlating scores for perceived intensity of pain and pain related disability with scores for perceived functionality in the participants as a whole, a moderate-to-strong ($r = 0.516 – 0.626$) correlation between pain-induced disability and the number of days that pain interfered with ADL was found. Thus, whenever chronic pain was so intense that it caused disability, ADL were not supported.

Discussion

Results from the CPG suggest that chronic pain symptoms are responsive to hydrotherapy exercise as a non-pharmacological pain-management strategy. This supports previous studies reporting analgesic effects of regular exercise (Cozzensa da Silva *et al*., 2012) and hydrotherapy (Bender *et al*., 2005; Becker, 2009; Wong & Scudds, 2009).

The FSI results demonstrated that six weeks of structured participation in hydrotherapy classes decreased the experimental group's perception of the amount of assistance required with ADL and experience of pain and difficulty in performing ADL. These results are relevant, since the performance of ADL in the elderly population is important for independence in daily living (Gokkaya *et al*., 2012).

The experimental group showed a significant improvement in upper-body strength and endurance throughout the six weeks. However, the control group illustrated a similar statistically significant improvement. This enhancement can thus not be attributed to the intervention *per se* and may be a result of variations in motivation, mood or energy levels on the days of testing, or to familiarisation with the testing procedures. This reported improvement warrants further investigation since upper-body strength and endurance are essential components of physical functionality in the elderly (Garatachea *et al.*, 2009).

The correlations found between chronic pain and perceived functionality parameters, showed a moderate-to-strong negative relationship between chronic pain and functionality. Thus, as perception of chronic pain decreased, perception of functionality improved. The implication for health care practitioners is that treatment of chronic pain with structured hydrotherapy could improve both pain intensity and functioning. Furthermore, the elderly's ability to take care of themselves may be strongly dependent on decreasing their chronic pain intensity (Yücel & Kayihan, 2011; Gokkaya *et al*., 2012). If pain relief is achieved, the subsequent ability to maintain ADL may support their upper- and lower-body muscular function.

It is interesting to note that the mean scores for pain intensity at pre-intervention testing were quite similar for the two groups (Figure 1). However, some individuals volunteered to participate in the exercise programme (ie. the experimental group) while others preferred to remain inactive (ie. the control group) even though they were educated by the researchers as to the potential benefits of hydrotherapy exercise to pain management. It is further interesting to note that those who chose not to participate in exercise also demonstrated a significantly poorer emotional state (results from the SF 36) and upper body functionality during pre-intervention testing (Figure 2).

These findings indicate that patients respond differently to the chronic pain experience, in that some are more motivated to engage in physical exercise to improve their functional status while those who are already in a compromised emotional and physical state may be resistant to suggestions of physical activity. This finding emphasises the importance of integrating structured exercise at an early stage of multimodal chronic pain management.

Conclusions and recommendation

Participation in a structured hydrotherapy exercise programme of two days per week for a period of six weeks may benefit pain perception, physical functionality and quality of life in elderly populations suffering from chronic pain symptoms. However, those patients who self-report impaired functional status may be more resistant to exercise participation. It is recommended that the study be repeated on a larger-sample population with higher pain levels over a longer intervention period.

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